Humans and Digital Agents – A Mutual Collaboration

Current Systems

Network of Humans

Thematic Context

Human

Syntactic Context
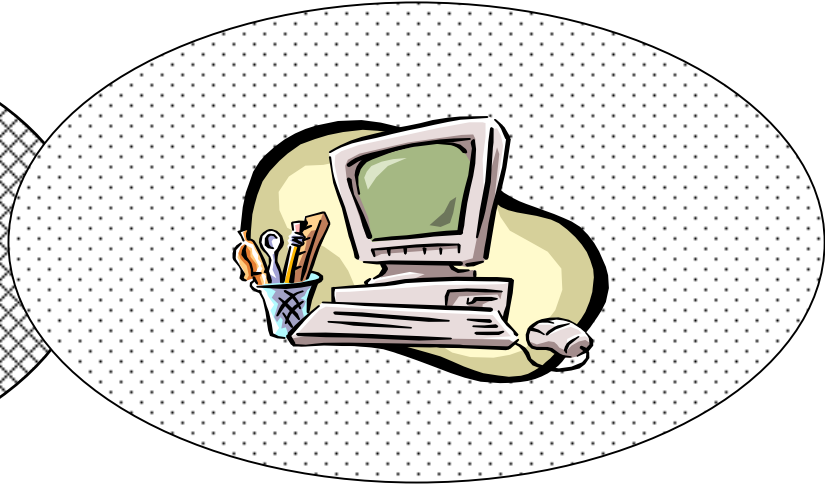
Digital

Digital Network
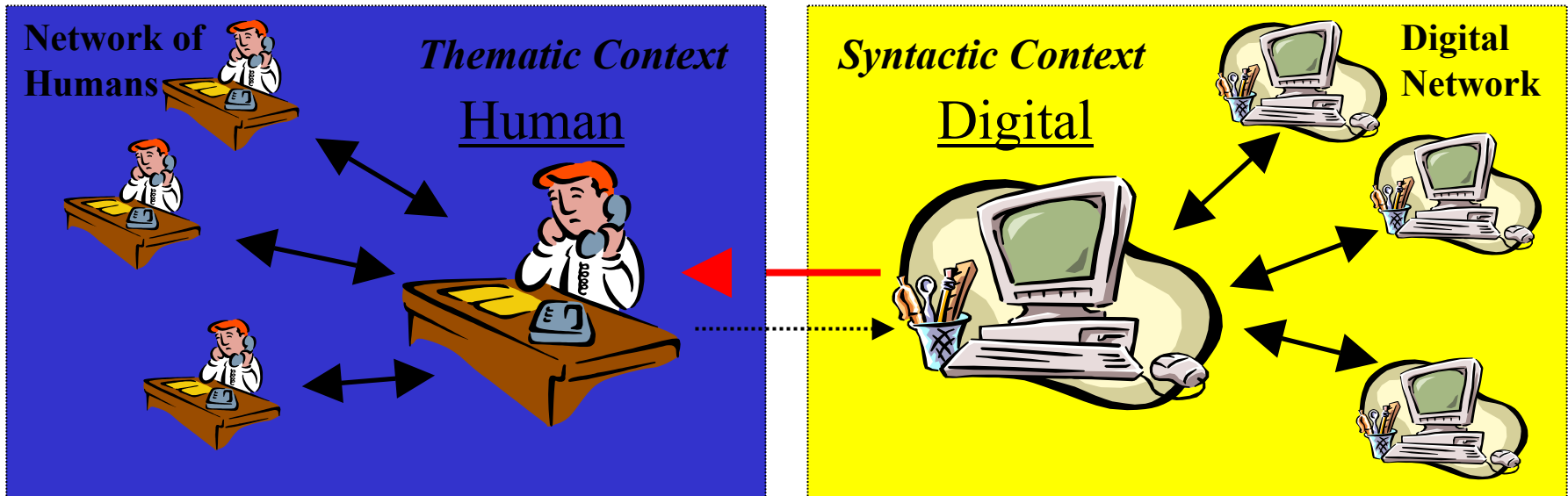
- Current systems: Digital system aids human by supplying needed information

Too many constraints

Too few constraints

Using Context to Limit the Problem Space

Problem space

Reduce problem space by specifying context
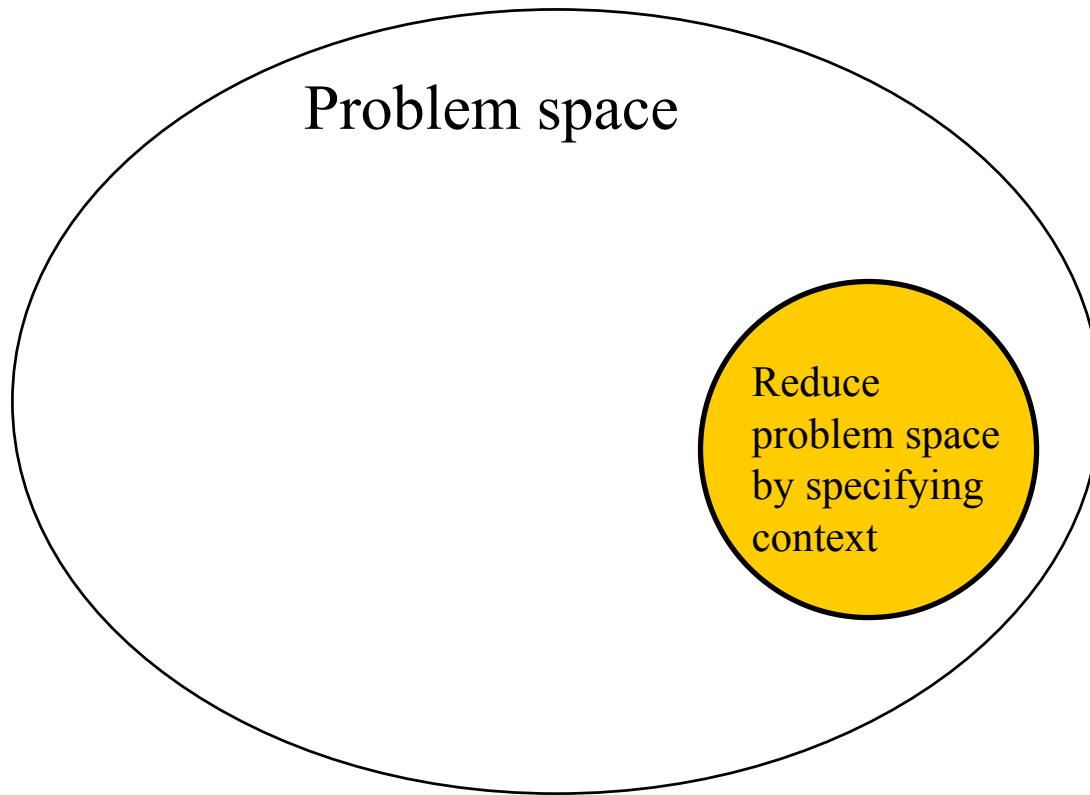
Humans and Digital Agents –
A Collaborative Ecology

Aug Cog Vision

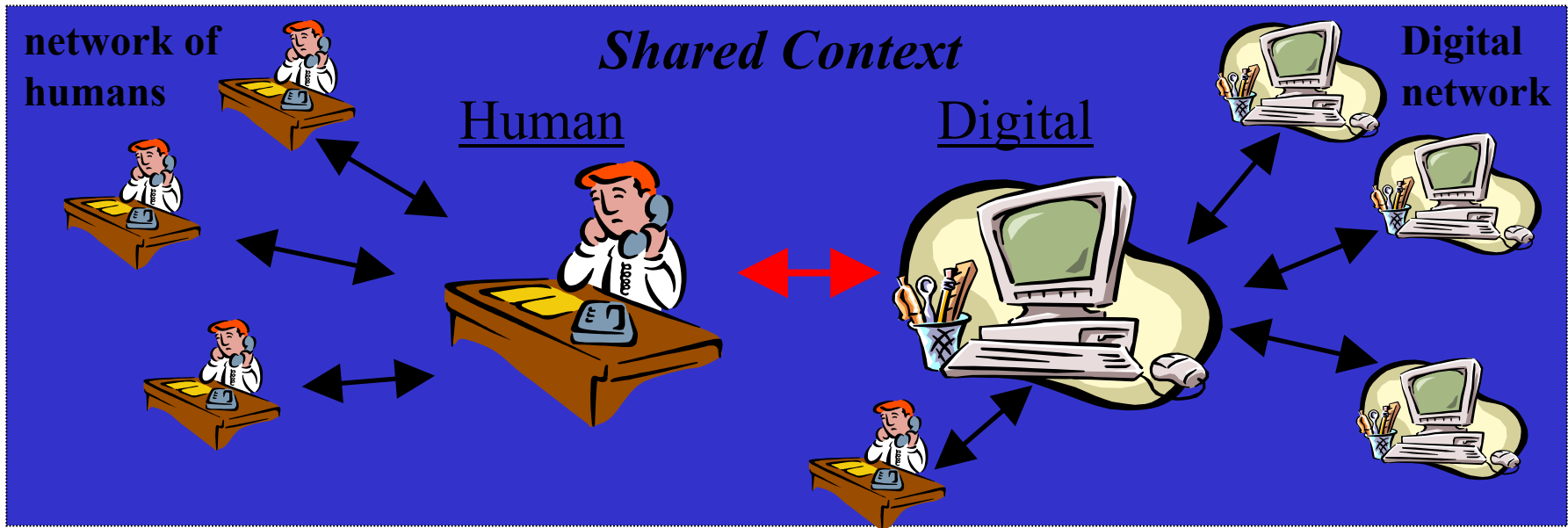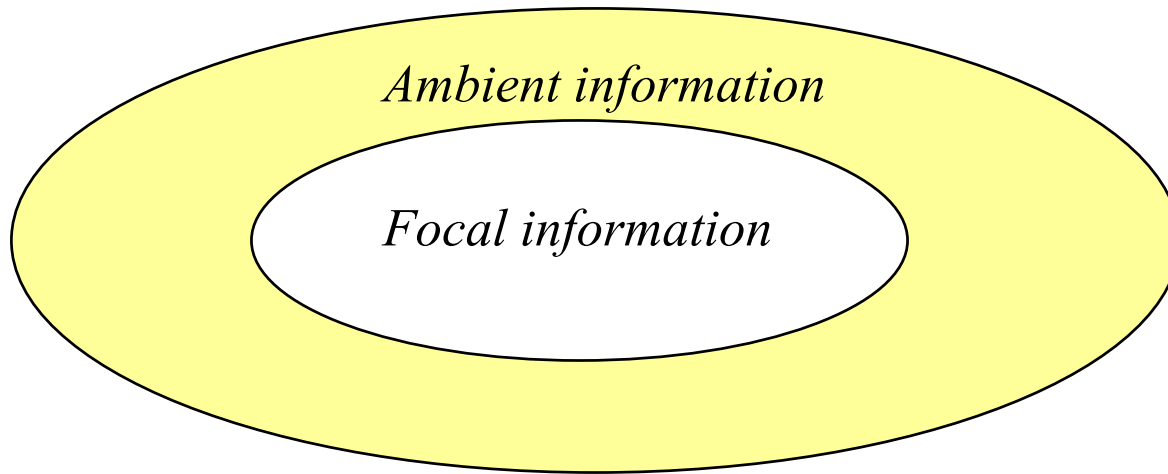- Digital system aids human by supplying context-relevant information
- Human aids digital system by providing contextual information
- Temporal attunement of human-digital systems

Focal and Ambient Information

Ambient information

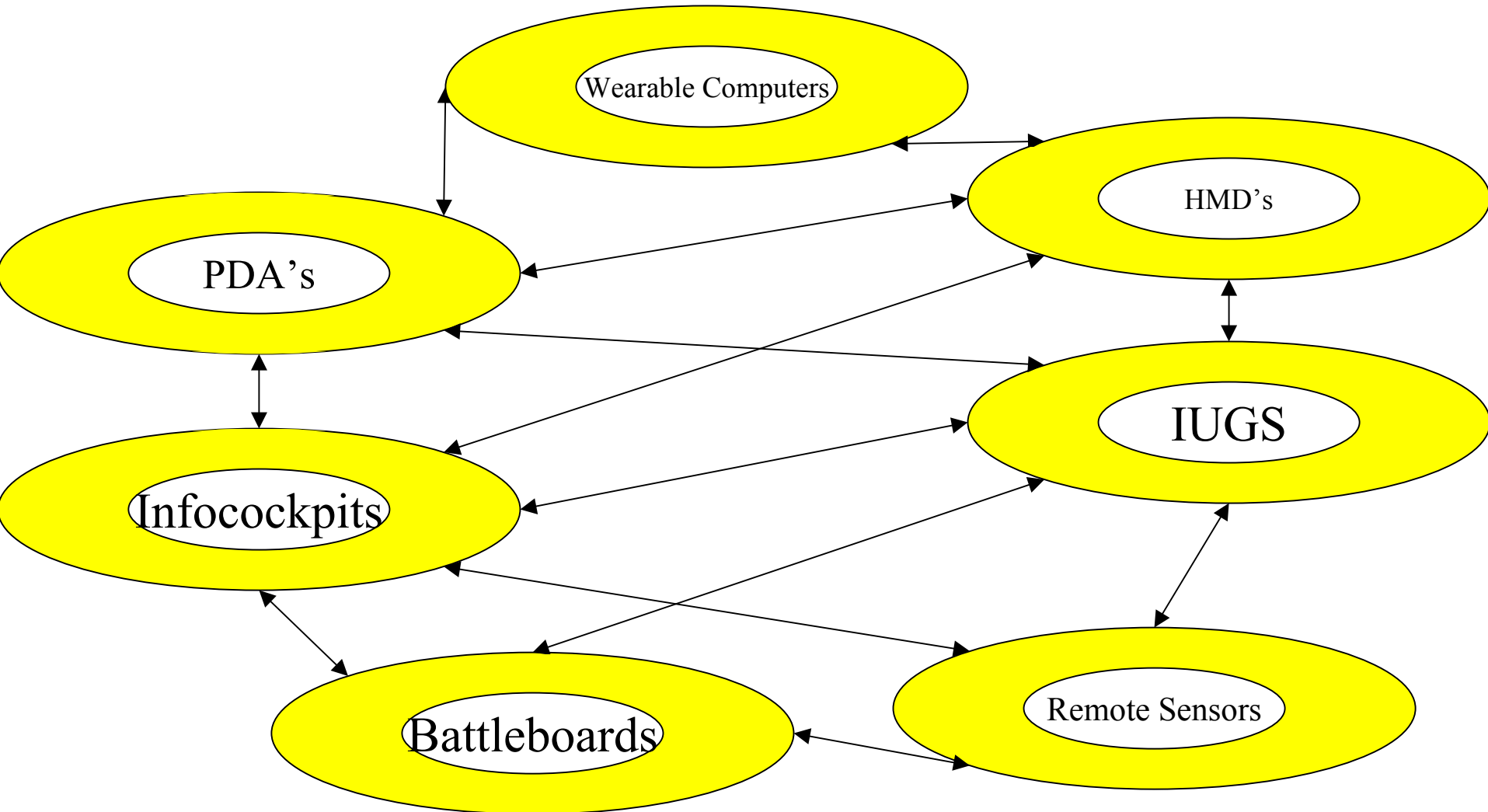*Focal information*

InfoCockpit displays **content** as **focal** information and **context** as **ambient** information.

The focal/ambient nature of information needs to be preserved and communicated at all levels of technology.

A Collaborative Ecology

Improving Decision Making:

Understanding and Displaying Uncertainty

- Understanding what is known is important – positive information
- But just as important is what is *not known*, and the relative certainty of data values
    - Examples of old maps, different sensors
    - "Understand the parameters of the lies that you are being told"

  <div align="right">– Gen. Holcomb</div>

- Decision-making and reasoning literature is relevant here

Non-inertial thinking machine

- Context-sensitive, user-attuned

- Generates and presents alternative realities
  - Gather information
  - Analyze information not currently displayed
  - Generate scenarios

- Presentation of expected utility
  - Significance, consequence and uncertainty symbology
  - Ambient information – sonification or visualization of knowledge

Non-inertial thinking machine: Challenges

- Context tracking

- Exploiting agent and related technology

- Estimation and effective display of uncertainty and significance

Non-inertial thinking machine: Approach

- Context tracking
  - Attunement
  - Sensing features of context

Detailed Approach: Contextual Tracking

- Literature Review
  - Sensor/data stream -> Digital information
- Develop Taxonomy of Context
  - Levels of analysis
- Context learning
  - Bayesian, unsupervised, scripted techniques

Non-inertial thinking machine: Approach

- Exploiting agent and related technology
  - What's been done
  - What's useful
  - What's missing

Detailed Approach: Exploiting Agent-like Technologies

- Literature Review
  - Launch-points: Woolridge & Jennings; Nwana & colleagues; DAML
- Determine current status of relevant technologies (Commander Data)
  - Context-relevant database search
  - Scenario-development/ pruning
  - Decision-aiding/recommendations
- Define desired "Intelligence" of digital partner
  - Generate alternative configurations not under consideration
  - Expand possibilities
  - Highlight knowledge gaps

Non-inertial thinking machine: Approach

- Estimation and effective display of uncertainty and significance
  - Identify uncertainty criticality
  - Modeling uncertainty
  - Effective display and interaction design
  - Guide human reasoning

Detailed Approach: Uncertainty and Significance

- Review state of the art
  - Decision support
- Identify error tendencies, decision bottlenecks and command priorities
- Develop and evaluate visualization & other support technologies
  - Incorporate attentional models
  - Expand perceptual capabilities (windows of temporal/spatial integration)

Non-inertial thinking machine: Deliverables

- Near-term (2-3 years)
  - Technology survey and assessment
  - Part-task design, experiments and simulations
  - Feasibility demonstrations
  - Testbed and supporting tools

Non-inertial thinking machine: Deliverables

- Mid-term (5 years)
  - Demonstration project(s)
  - Field testing
  - Integrated CAE demonstration

Non-inertial thinking machine: Deliverables

- Far-term (10 years)
  - Mission technology development
  - Large-scale validation
  - Technology transfer

Lingering Problems

- Emotion and decision-making
- Fatigue and stress
- Computer object recognition and "self-organizing semantic networks"
- Positive and negative information
- Intuition